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(2)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/317,536	05/24/99	ZHAO	B 97RSS256-DIV

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MM42/1210

EXAMINER

OWENS, D

ART UNIT

PAPER NUMBER

2811

3

DATE MAILED: 12/10/99

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.

09/317,536

Applicant(s)

ZHAO ET AL.

Examiner

Douglas W Owens

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 16-27 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 16-27 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claims ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- a) ☐ All b) ☐ Some * c) ☐ None of the CERTIFIED copies of the priority documents have been:
1. ☐ received.
2. ☐ received in Application No. (Series Code / Serial Number) ____.
3. ☐ received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. & 119(e).

Attachment(s)

- 14) ☒ Notice of References Cited (PTO-892)
- 15) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 16) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____.
- 17) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 18) ☐ Notice of Informal Patent Application (PTO-152)
- 19) ☐ Other: _____.

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DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 16-21, and 23-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over admitted prior art in view of Chiang et al., US patent No., 5,886,410.

Regarding claim 16, admitted prior art teaches an interconnect comprising:

one or more metal lines formed from a first metal layer having gaps between said lines;

low-k material filling the gaps between the metal lines and having a height and vertical portions;

a dielectric layer formed over the low-k material and metal lines;

vias etched in the dielectric layer;

a metal for filling the vias; and

a second metal layer over the dielectric layer.

Admitted prior art does not teach a protective layer disposed on top of the low-k material layer, wherein said protective layer has openings for allowing the metal in the vias to contact the first metal lines. Chiang et al. Teaches an interconnect wherein a protection layer is disposed on top of the low-k material layer, said protection layer

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having openings for allowing metal in the vias to contact the metal lines. It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teaching of Chiang with admitted prior art since the protection layer will improve the mechanical strength of the interconnect system. Furthermore, it is obvious to form openings in the protection layer in order to electrically connect the conductive lines.

Regarding claims 17, 18, 19, 20, 21, and 23, admitted prior art does not teach an interconnect wherein the protective layer is an oxide, silicon dioxide, a dielectric, or silicon carbon. Chiang teaches an interconnect wherein the protective layer is silicon dioxide or a silicon dioxide combined with a silicon nitride. It would have been obvious to one of ordinary skill in the art to use an oxide, silicon dioxide, silicon nitride, or silicon carbon since they are well known materials, and are well suited for their intended use. Furthermore, these materials are well known for their use as dielectrics.

Regarding claims 24 and 25, admitted prior art teaches an interconnect wherein the first metal layer can be an aluminum alloy or tungsten, the metal filling the vias can be an aluminum alloy or tungsten, and the second metal layer can be an aluminum alloy or tungsten.

Regarding claims 26 and 27, admitted prior art teaches an interconnect wherein the dielectric layer comprises silicon dioxide. Admitted prior art does not teach an interconnect wherein the protective layer is silicon nitride, and the low-k material is an organic low-k material. Chiang teaches an interconnect wherein the protective layer is

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silicon nitride, and the low-k material is an organic low-k material. Neither admitted prior art, nor Chiang teach a low-k dielectric layer comprising a porous silicon dioxide. It would have been obvious to one of ordinary skill in the art to incorporate the teaching of Chiang into the device taught by admitted prior art since the organic material taught by Chiang has a dielectric constant in the desired range. Furthermore, silicon nitride and porous silicon dioxide are well known materials that are well suited for their intended use and would have been obvious to use. The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945)

3. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al. as applied to claims 16-21 above, and further in view of Chen et al. US patent No. 5,317,192.

Chiang does not teach an interconnect wherein a spacer is disposed on the vertical portion of the low-k material in the vias. Chen teaches an interconnect wherein a spacer is disposed on the vertical portion of the dielectric. It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teaching of Chen into Chiang's device, since the sidewall spacer will prevent lateral diffusion of impurities.

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Havemann et al., US patent No., 5,661,344. Havemann et al.,

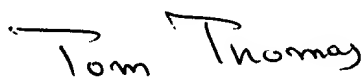
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US patent No., 5,747,880. Sun et al., US patent No., 5,262,353. Gnade et al., US patent No., 5,789,819.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Douglas W Owens whose telephone number is 703-308-6167. The examiner can normally be reached on Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.


Tom Thomas
Supervisory Patent Examiner
Technology Center 2800

DWO
December 6, 1999